Special Flood Hazard Evaluation Report

Hosmer Brook

Town of Sardinia, Erie County, New York

Prepared for the
New York State Department of Environmental Conservation

US Army Corps
of Engineers
Buffalo District

January 1996

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This technical report documents the result of an investigation to determine the potential flood situation along Hosmer Brook, within the Town of Sardinia, Erie County, New York. The study reach includes Hosmer Brook from its confluence with Cattaraugus Creek, upstream to Genesee Road. This report identifies the 100-year and 500-year flood plains and 100-year floodway for the reaches studied.

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SPECIAL FLOOD HAZARD EVALUATION REPORT
HOSMER BROOK
TOWN OF SARDINIA, ERIE COUNTY, NY

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INTRODUCTION

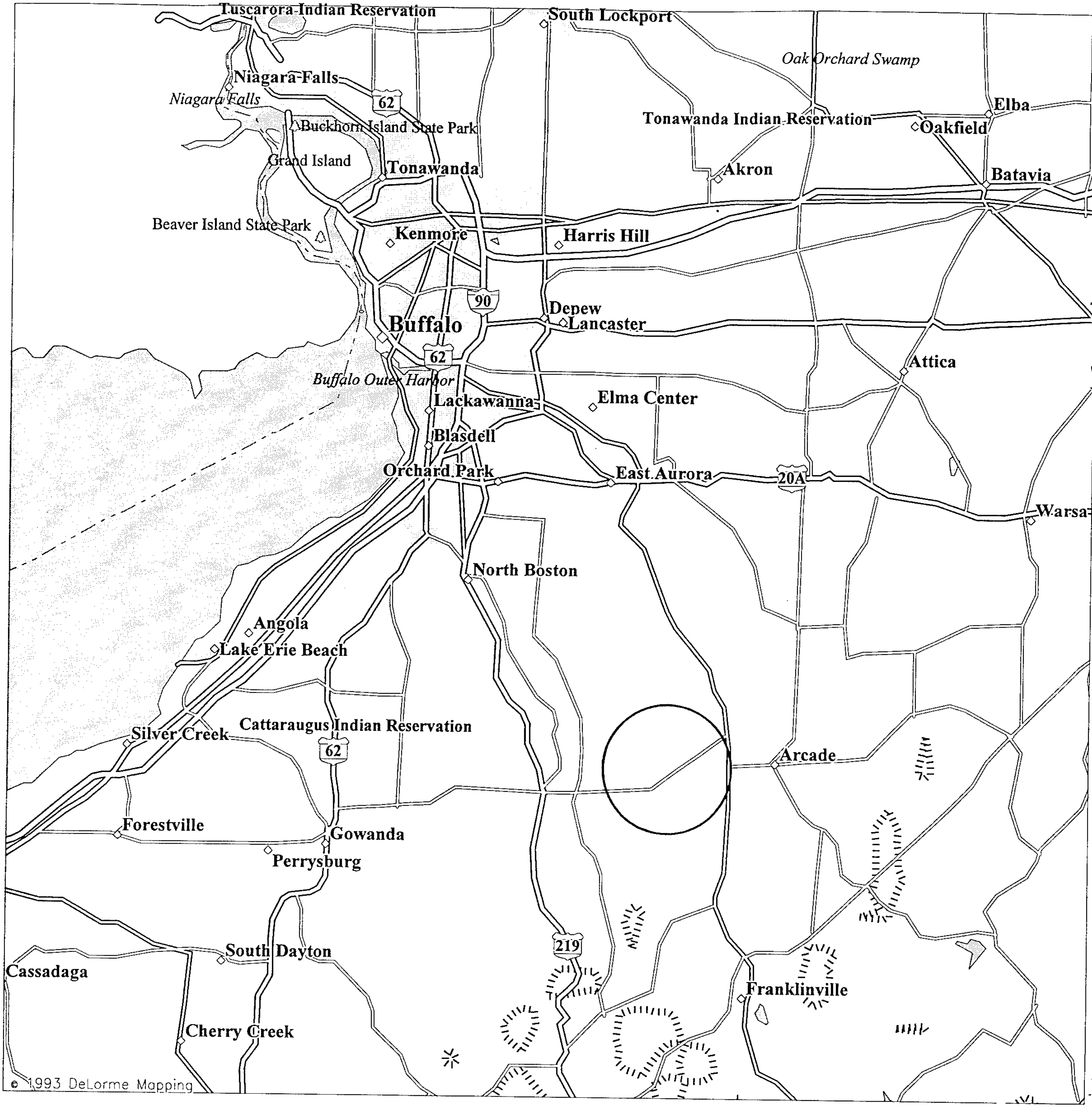
This Special Flood Hazard Evaluation Report documents the results of an investigation to determine the potential flood situation along Hosmer Brook within the Town of Sardinia, Erie County, New York. This study was conducted at the request of the New York State Department of Environmental Conservation under the authority of Section 206 of the 1960 Flood Control Act, as amended. The study reach includes Hosmer Brook from its confluence with Cattaraugus Creek, upstream to Genesee Road.

The Town of Sardinia is located in southeastern Erie County in northwestern New York, approximately 30 miles southeast of Buffalo. The town is bordered on the north by the towns of Colden and Holland, on the east by Wyoming County, on the south by Cattaraugus Creek and Cattaraugus County, and on the west by the town of Concord. The Sardina population is 2,667 according to the 1990 census (Reference 1). Hosmer Brook originates in the town of Sardinia and flows south to Cattaraugus Creek just west of the Village of Arcade.

Knowledge of potential floods and flood hazards is important in land use planning. This report identifies the 100-year and 500-year flood plains and 100-year floodway for the reaches studied.

Information developed for this study will be used by local officials to manage future flood plain development. While the report does not provide solutions to flood problems, it does furnish a suitable basis for the adoption of land use controls to guide flood plain development, thereby preventing intensification of the flood loss problem. It will also aid in the development of other flood damage reduction techniques to modify flooding and reduce flood damages which might be embodied in an overall Flood Plain Management (FPM) program. Other types of studies, such as those of environmental attributes and the current and future land use roles of the flood plain as part of its surroundings, would also profit from this information.

Although Flood Insurance Rate Maps have been developed for the community, no detailed analyses was used to study the stream reaches analyzed in this study because the area was thought to have a low development potential at the time the maps were prepared. However, the area is now experiencing residential development pressure, and local officials requested detailed flood plain information to assist them in managing development.



LEGEND

Population Center
◇ Town, Small City
◇ Large City
Interstate, Turnpike
US Highway
National Boundary
Major Street/Road
State Route

Interstate Highway
US Highway
Open Water

Study Area

Scale 1:500,000 (at center)

10 Miles

10 KM

Town of Sardinia, NY - Vicinity Map
Mag 10.00
Fri Oct 06 09:07:54 1995

Figure 1

Additional copies of this report can be obtained from the New York State Department of Environmental Conservation until its supply is exhausted, and the National Technical Information Service of the U.S. Department of Commerce, Springfield, Virginia 22161, at the cost of reproducing the report. The Buffalo District Corps of Engineers will provide technical assistance and guidance to planning agencies in the interpretation and use of the hydrologic data obtained for this study.

PRINCIPAL FLOOD PROBLEMS

Although flooding may occur during any season, the principal flood problems have occurred during winter and spring months and are usually the result of spring rains and or snowmelt.

Flood Magnitudes and Their Frequencies

Floods are classified on the basis of their frequency or recurrence interval. A 100-year flood is an event with a magnitude that can be expected to be equaled or exceeded once on the average during any 100-year period. It has a 1.0 percent chance of occurring in any given year. It is important to note that, while on a long-term basis, the exceedence averages out to once per 100 years, floods of this magnitude can occur in any given year or even in consecutive years and within any given time interval. For example, there is a greater than 50 percent probability that a 100-year event will occur during a 70-year lifetime. Additionally, a house which is built within the 100-year flood level has about a one-in-four chance of being flooded in a 30-year mortgage life.

Hazards and Damages of Large Floods

The extent of damage caused by any flood depends on the topography of the flooded area, the depth and duration of flooding, the velocity of flow, the rate of rise in water surface elevation, and development of the flood plain. Deep water flowing at a high velocity and carrying floating debris would create conditions hazardous to persons and vehicles which attempt to cross the flood plain. Generally, water 3 or more feet deep which flows at a velocity of 3 or more feet per second could easily sweep an adult off his feet and create definite danger of injury or drowning. As indicated in Table 2, flow velocities of Hosmer Brook reach 9.6 feet per second in the reach studied. Rapidly rising and swiftly flowing floodwater may trap persons in homes that are ultimately destroyed or in vehicles that are ultimately submerged or floated. Since water lines can be ruptured by deposits of debris and by the force of flood waters, there is the possibility of contaminated domestic water supplies. Damaged sanitary sewer lines and sewage treatment plants could result in the pollution of floodwaters and could create health hazards. Isolation of areas by floodwater could create hazards in terms of medical, fire, or law enforcement emergencies.

HYDROLOGIC ANALYSES

Hydrologic analyses were carried out to determine the peak discharge-frequency relationships for the flooding sources affecting the community. Hydrology was developed for two reaches on Hosmer Brook. The peak discharges were calculated using the Regional Equations of WRI 90-4197 (Reference 2). Watershed characteristics including contributing drainage area in square miles; main channel slope in feet per mile; and storage area in percent were developed using the Arcade and Sardinia, New York quadrangle maps (Reference 3) and the guidelines of the National Handbook of Recommended Methods for Water Data Acquisition (Reference 4).

The annual peak discharges for Hosmer Brook are shown in Table 1.

TABLE 1
SUMMARY OF DISCHARGES

Flooding Source and Location	Drainage Area (sq. mi.)	Peak Discharges 100-Year (cfs)	Peak Discharges 500-Year (cfs)
Hosmer Brook			
At confluence with Cattaraugus Creek	9.2	1,690	2,260
Just downstream of Genesee Road	7.5	1,500	2,020

HYDRAULIC ANALYSES

Analyses of the hydraulic characteristics of flooding from sources studies were carried out to provide estimates of the elevations of floods for the 100-year and 500-year recurrence intervals.

Cross-section data for the backwater analyses of Hosmer Brook were obtained from field surveys performed by Buffalo District personnel in November 1994. Additional data were obtained from topographic maps (Reference 3). All bridges and culverts were surveyed to determine elevation data and structural geometry. Spot elevations were obtained in the overbank areas in order to accurately delineate the flood plain boundaries.

Water surface elevations of the 100-year and 500-year recurrence interval flood events were computed using the COE HEC-2 step-backwater computer program (Reference 5). The slope-area method was used to establish the starting water surface elevation for Hosmer Brook.

Locations of the selected cross-sections used in the hydraulic analyses are shown on the Flood Profile (Plate 1) and on the Flooded Areas Map which accompany this report.

Channel and overbank roughness factors (Manning's "n") used in the hydraulic computations were selected using engineering judgement and were based on field observations of the stream and flood plain areas. The values for Manning's "n" and the contraction and expansion coefficients are shown in Table 2.

TABLE 2
MANNING'S "N" AND CONTRACTION & EXPANSION COEFFICIENTS

Flooding Source	Channel	Overbank	Contraction	Expansion
Hosmer Brook	.030 - .040	.070	.1 - .3	.3 - .5

Flood profiles were drawn showing the computed water surface elevations for the selected recurrence intervals. The flood plain boundaries were delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using the topographic maps and spot elevations obtained during the field surveys. Small areas within the flood plain boundaries may be above the flood elevations, but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

Floodways were determined for the streams studied in detail. Floodway encroachments were based on equal conveyance reduction from each side of the flood plain, with adjustments as necessary to provide functional and manageable floodways. At the request of the New York State Department of Environmental Conservation, the maximum increase in stage due to encroachment was limited to 1 foot, provided that hazardous velocities were not produced. Floodway widths were computed at cross sections and varied from 49 to 91 feet. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections and are shown in Table 3.

The computed floodways are also shown on the Flooded Area Map. In cases where the floodway and the 100-year flood plain boundaries are either close together or collinear, only the floodway boundary is shown.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profile are considered valid only if hydraulic structures remain unobstructed, operate properly, and do no fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Descriptions of the marks are presented in Table 4.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
A	80	49	177	9.6	1300.1	1300.1	1300.3	0.2
B	800	50	339	5.0	1303.2	1303.2	1304.0	0.8
C	2,500	50	216	7.8	1320.2	1320.2	1320.2	0.0
D	5,000	66	178	9.5	1344.9	1344.9	1344.9	0.0
E	5,900	81	191	8.9	1357.6	1357.6	1357.6	0.0
F	6,587	91	329	4.6	1373.1	1373.1	1373.7	0.6
G	8,000	57	246	6.1	1383.3	1383.3	1384.2	0.9
H	9,500	60	320	4.7	1395.2	1395.2	1396.1	0.9
J	11,095	74	294	5.1	1405.7	1405.7	1406.6	0.9

1 Distance is measured in feet from confluence with Cattaraugus Creek.

TOWN OF SARDINIA
ERIE COUNTY, NEW YORK

FLOODWAY DATA

HOSMER BROOK

TABLE 3

TABLE 4
ELEVATION REFERENCE MARKS

Reference Mark	Elevation	Description
Hosmer Brook		
RM-1	1371.26	Brass disk (#11-N 1961) located 84 feet south, 76 feet west, and 0.8 feet lower than intersection of Creek Road and Buffalo (Savage) Road; in a concrete step at residence front entrance.
RM-2	1308.58	Yellow chiseled square on upstream left top of concrete abutment on Savage Road bridge over Cattaraugus Creek.
RM-3	1397.82	USC&GS benchmark; a brass disk marked "S 15NY 1922" located at northeast intersection of Buffalo (Savage) Road and State Route 39 in top of concrete porch of two story wood frame structure.
RM-4	1415.40	Yellow mark on downstream side of bridge rail; top of downstream right concrete guardrail post of Genesee Road bridge over Hosmer Brook.

UNIFIED FLOOD PLAIN MANAGEMENT

Historically, the alleviation of flood damage has been accomplished almost exclusively by the construction of protective works such as reservoirs, channel improvements, and floodwalls and levees. However, in spite of the billions of dollars that have already been spent for construction of well-designed and efficient flood control works, annual flood damages continue to increase because the number of persons and structures occupying floodprone lands is increasing faster than protective works can be provided.

Recognition of this trend has forced a reassessment of the flood control concept and resulted in the broadened concept of unified flood plain management programs. Legislative and administrative policies frequently cite two approaches: structural and nonstructural, for adjusting to the flood hazard. In this context, "structural" is usually intended to mean adjustments that modify the behavior of floodwaters through the use of measures such as dams and channel work. "Nonstructural" is usually intended to include all other adjustments in the way society acts when occupying or modifying a flood plain (e.g., regulations, floodproofing, insurance, etc.). Both structural and nonstructural tools are used for achieving desired future flood plain conditions. There are three basic strategies which may be applied individually or in combination: (1) modifying the susceptibility to flood damage and disruption, (2) modifying the floods themselves, and (3) modifying (reducing) the adverse impacts of floods on the individual and the community.

Modify Susceptibility to Flood Damage and Disruption

The strategy to modify susceptibility to flood damage and disruption consists of actions to avoid dangerous, economically undesirable, or unwise use of the flood plain. Responsibility for implementing such actions rests largely with the non-Federal sector and primarily at the local level of government.

These actions include restrictions in the mode and the time of occupancy; in the ways and means of access; in the pattern, density, and elevation of structures and in the character of their materials (structural strength, adsorptiveness, solubility, corrodibility); in the shape and type of buildings and in their contents; and in the appurtenant facilities and landscaping of the grounds. The strategy may also necessitate changes in the interdependencies between flood plains and surrounding areas not subject to flooding, especially interdependencies regarding utilities and commerce. Implementing mechanisms for these actions include land use regulations, development and redevelopment policies, floodproofing, disaster preparedness and response plans, and flood forecasting and warning systems.

Different tools may be more suitable for developed or underdeveloped flood plain or for urban or rural areas. The information contained in this report is particularly useful for the preparation of flood plain regulations.

a. Flood Plain Regulations.

Flood plain regulations apply to the full range of ordinances and other means designed to control land use and construction within floodprone areas. The term encompasses zoning ordinances, subdivision regulations, building and housing codes, encroachment line statutes, open area regulations, and other similar methods of management which affect the use and development of floodprone areas.

Flood plain land use management does not prohibit use of floodprone areas; to the contrary, flood plain land use management seeks the best use of flood plain lands. The flooded area maps and the water surface profiles contained in this report can be used to guide development in the flood plain. The elevations shown on the profile should be used to determine flood heights because they are more accurate than the outlines of flooded areas. It is recommended that development in areas susceptible to frequent flooding adhere to the principles expressed in Executive Order 11988 - Flood Plain Management, whose objective is to "... avoid to the extent possible the long- and shortterm adverse impacts associated with the occupancy and modification of flood plains ... whenever there is a practicable alternative." Accordingly, development in areas susceptible to frequent flooding should consist of construction which has a low damage potential such as parking areas, parks, and golf courses. High value construction such as buildings, should be located outside the flood plain to the fullest extent possible. In instances where no practicable alternative exists, the land should be elevated to minimize damages. If it is uneconomical to elevate the land in these areas, means of floodproofing the structure should be given careful consideration.

b. Development Zones.

A flood plain consists of two zones. The first zone is the designated "floodway" or that cross sectional area required for carrying or discharging the anticipated flood waters with a maximum 1-foot increase in flood level (New York State Department of Environmental Conservation standard). Velocities are the greatest and most damaging in the floodway. Regulations essentially maintain the flow-conveying capability of the floodway to minimize inundation of additional adjacent areas. Uses which are acceptable for floodways include parks, parking areas, open spaces, etc.

The second zone of the flood plain is termed the "floodway fringe" or restrictive zone, in which inundation might occur but where depths and velocities are generally low. Although not recommended if practicable alternatives exist, such areas can be developed provided structures are placed high enough or floodproofed to be reasonably free from flood damage during the 100-year flood. Typical relationships between the floodway and floodway fringe are shown in Figure 2. The floodways for Hosmer Brook have been plotted on the Flooded Area Map.

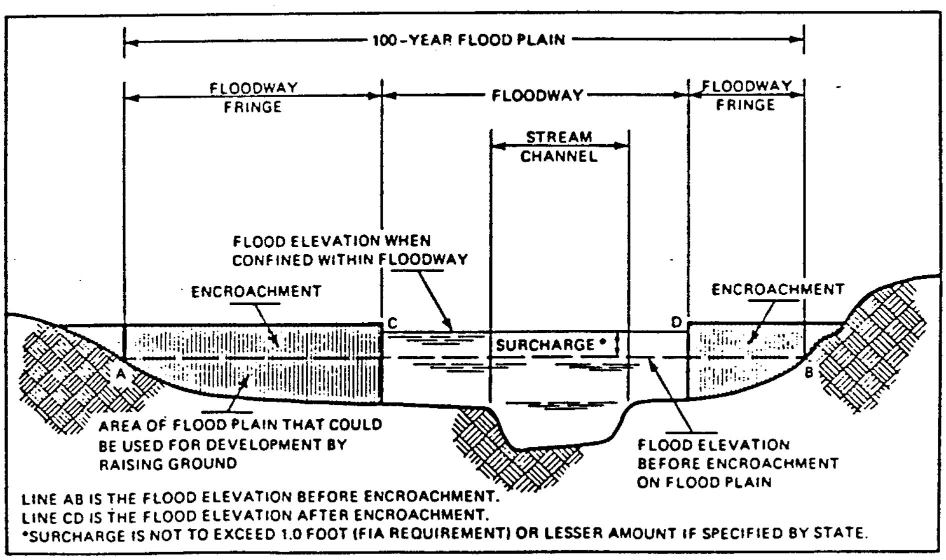


Figure 2 - Floodway Schematic

c. Formulation of Flood Plain Regulations.

Formulation of flood plain regulations in a simplified sense involves selecting the type and degree of control to be exercised for each specific flood plain. In principle, the form of the regulations is not as important as a maintained adequacy of control. The degree of control normally varies with the flood hazard as measured by depth of inundation, velocity of flow, frequency of flooding, and the need for available land. Considerable planning and research is required for the proper formulation of flood plain regulations. Formulation of flood plain regulations may require a lengthy period of time during which development is likely to occur. In such cases, temporary regulations should be adopted and amended later as necessary.

Modify Flooding

The traditional strategy of modifying floods through the construction of dams, dikes, levees and floodwalls, channel alterations, high flow diversions and spillways, and land treatment measures has repeatedly demonstrated its effectiveness for protecting property and saving lives, and it will continue to be a strategy of flood plain management. However, in the future, reliance solely upon a flood modification strategy is neither possible nor desirable. Although the large capital investment required by flood modifying tools has been provided largely by the Federal government, sufficient funds from Federal sources have not been and are not likely to be available to meet all situations for which flood modifying measures would be both effective and economically feasible. Another consideration is that the cost of maintaining and operating flood control structures falls upon local governments.

Flood modifications acting alone leave a residual flood loss potential and can encourage an unwarranted sense of security leading to inappropriate use of lands in the areas that are directly protected or in adjacent areas. For this reason, measures to modify possible floods should usually be accompanied by measures to modify the susceptibility to flood damage, particularly by land use regulations.

Modify the Impact of Flooding on Individuals and the Community

A third strategy for mitigating flood losses consists of actions designed to assist individuals and communities in their preparatory, survival, and recovery responses to floods. Tools include information dissemination and education, arrangements for spreading the costs of the loss over time, purposeful transfer of some of the individual's loss to the community by reducing taxes in flood prone areas, and the purchase of Federally subsidized flood insurance.

The distinction between a reasonable and unreasonable transfer of costs from the individual to the community can also be regulated and is a key to effective flood plain management.

CONCLUSION

This report presents local flood hazard information for Hosmer Brook in the town of Sardinia, New York. The U.S. Army Corps of Engineers, Buffalo District, will provide interpretation in the application of the data contained in this report, particularly as to its use in developing effective flood plain regulations. Requests should be coordinated with the New York State Department of Environmental Conservation.

GLOSSARY

BACKWATER EFFECT — The resulting rise in water surface in a given stream due to a downstream obstruction or high stages in an intersecting stream.

BASE FLOOD — A flood which has an average return interval in the order of once in 100 years, although the flood may occur in any year. It is based on statistical analysis of streamflow records available for the watershed and analysis of rainfall and runoff characteristics in the general region of the watershed. It is commonly referred to as the "100-year flood."

DISCHARGE — The quantity of flow in a stream at any given time, usually measured in cubic feet per second (cfs).

FLOOD — An overflow of lands not normally covered by water. Floods have two essential characteristics: the inundation of land is temporary and the lands are adjacent to and inundated by overflow from a river, stream, ocean, lake, or other body of standing water.

Normally a "flood" is considered as any temporary rise in streamflow or stage, but not the ponding of surface water, that results in significant adverse effects in the vicinity. Adverse effects may include damages from overflow of land areas, temporary backwater effects in sewers and local drainage channels, creation of unsanitary conditions or other unfavorable situations by deposition of materials in stream channels during flood recessions, and rise of groundwater coincident with increased streamflow.

FLOOD CREST	The maximum stage or elevation reached by floodwaters at a given location.
FLOOD FREQUENCY	A statistical expression of the percent chance of exceeding a discharge of a given magnitude in any given year. For example, a <u>100-year flood</u> has a magnitude expected to be exceeded on the average of once every hundred years. Such a <u>flood</u> has a 1 percent chance of being exceeded in any given year. Often used interchangeably with <u>RECURRENCE INTERVAL</u>.
FLOOD PLAIN	The areas adjoining a river, stream, watercourse, ocean, lake, or other body of standing water that have been or may be covered by floodwater.
FLOOD PROFILE	A graph showing the relationship of water surface elevation to location; the latter generally expressed as distance upstream from a known point along the approximate centerline of a stream of water that flows in an open channel. It is generally drawn to show surface elevation for the rest of a specific flood, but may be prepared for conditions at a given time or stage.
FLOOD STAGE	The stage or elevation at which overflow of the natural banks of a stream or body of water begins in the reach or area in which the elevation is measured.
FLOODWAY	The channel of a watercourse and those portions of the adjoining flood plain required to provide for the passage of the selected flood (normally the 100-year flood) with an insignificant increase in the flood levels above that of natural conditions. As used in the National Flood Insurance Program, floodways must be large enough to pass the 100-year flood without causing an increase in elevation of more than a specified amount (1 foot in most areas).
RECURRENCE INTERVAL	A statistical expression of the average time between floods exceeding a given magnitude (see FLOOD FREQUENCY).

REFERENCES

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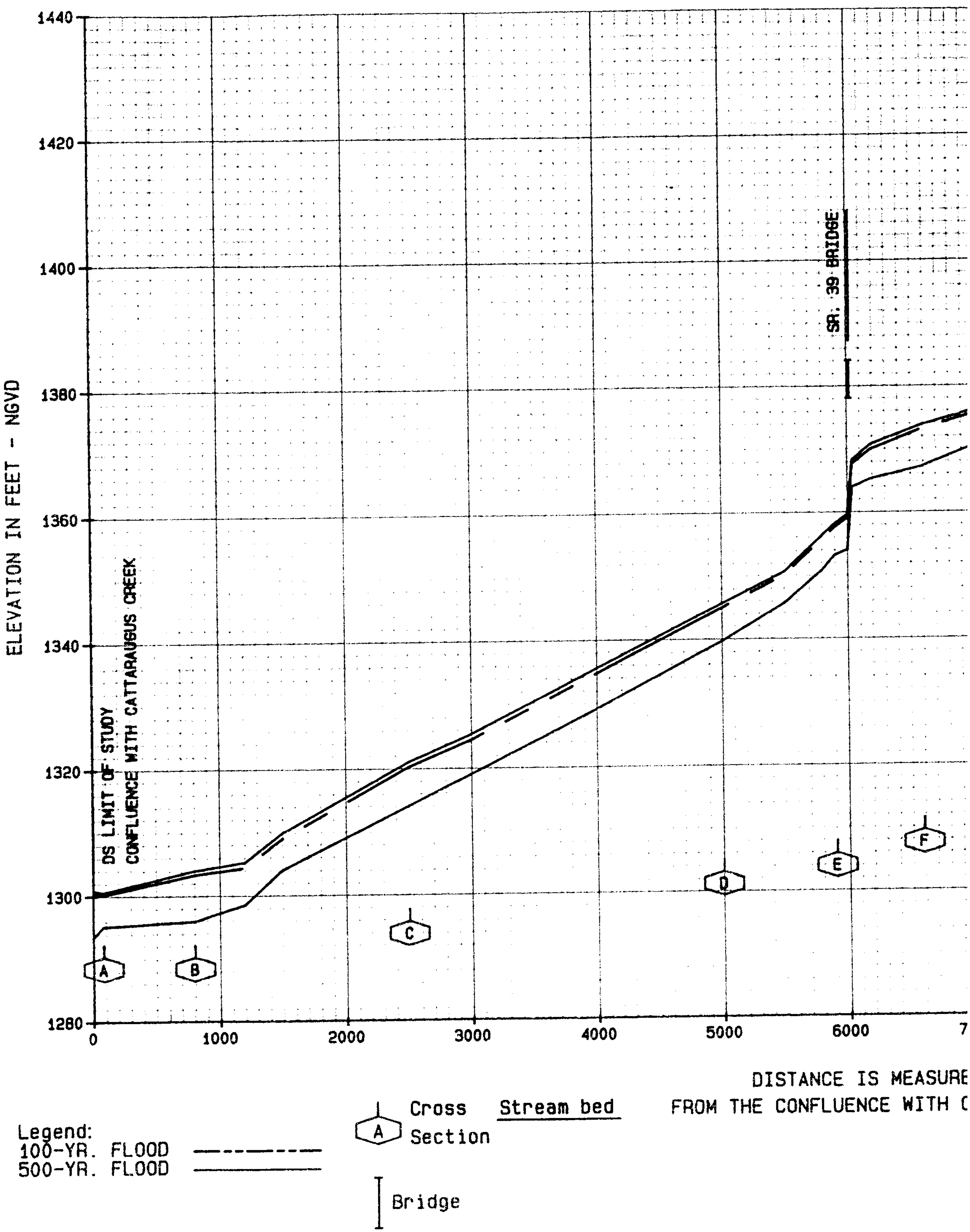
2. U.S. Department of Interior, Geological Survey, Water Resources Investigations Report 90-4197, Regionalization of Flood Discharges for Rural, Unregulated Streams in New York, excluding Long Island, 1991.

3. U.S. Department of the Interior, Geological Survey, 7.5 Minute Series (Topographic) Maps, Scale 1:24,000, Contour Interval 10 feet: Arcade, NY (photorevised 1979), and Sardinia (1957).

4. U.S. Department of Interior, Geological Survey, National Handbook of Recommended Methods for Water Data Acquisition, 1977.

5. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles Generalized Computer Program, Davis, California, 1987.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DS LIMIT OF STUDY
CONFLUENCE WITH CATTARAUGUS CREEK
SR. 39 BRIDGE
A
B
C
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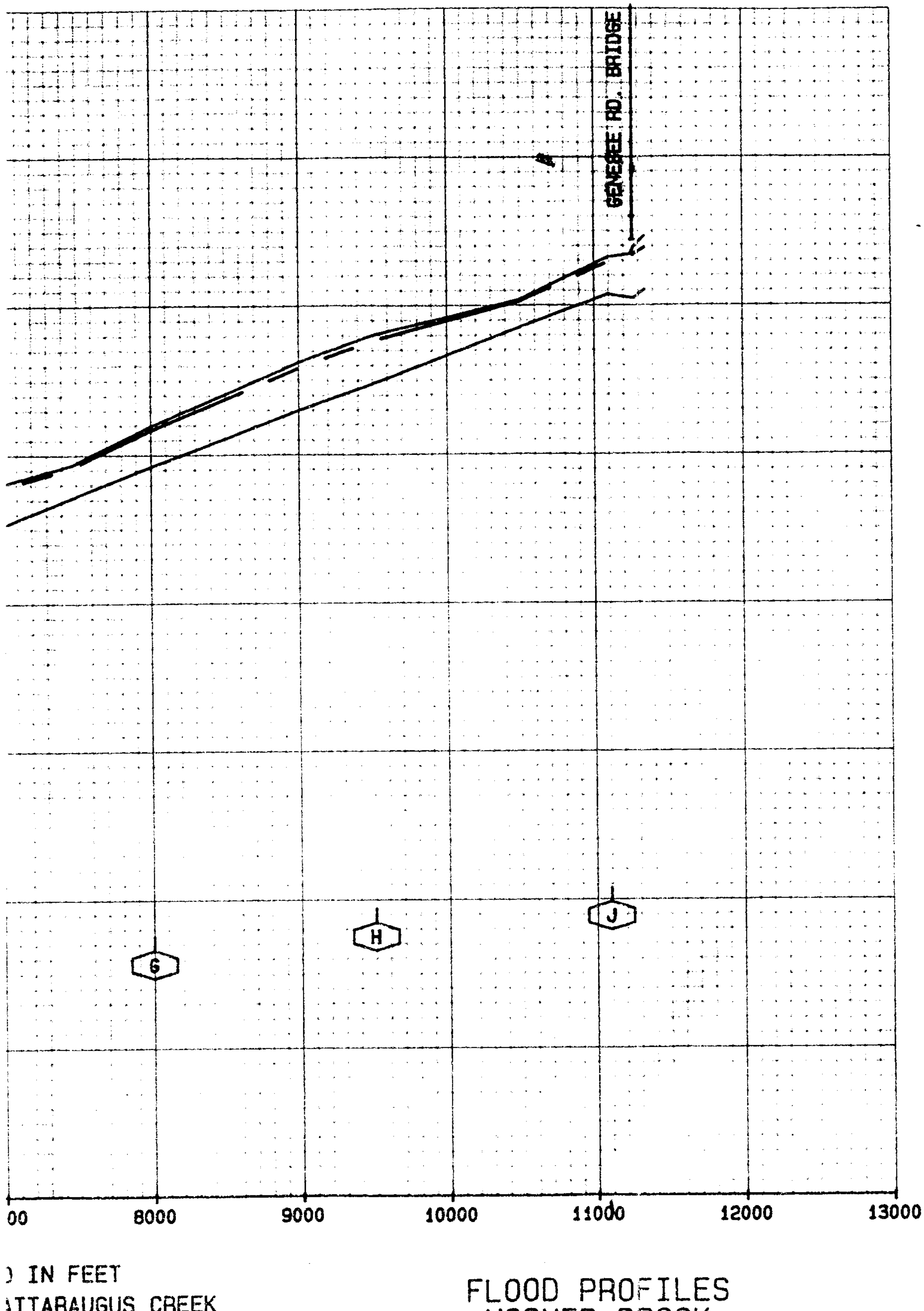
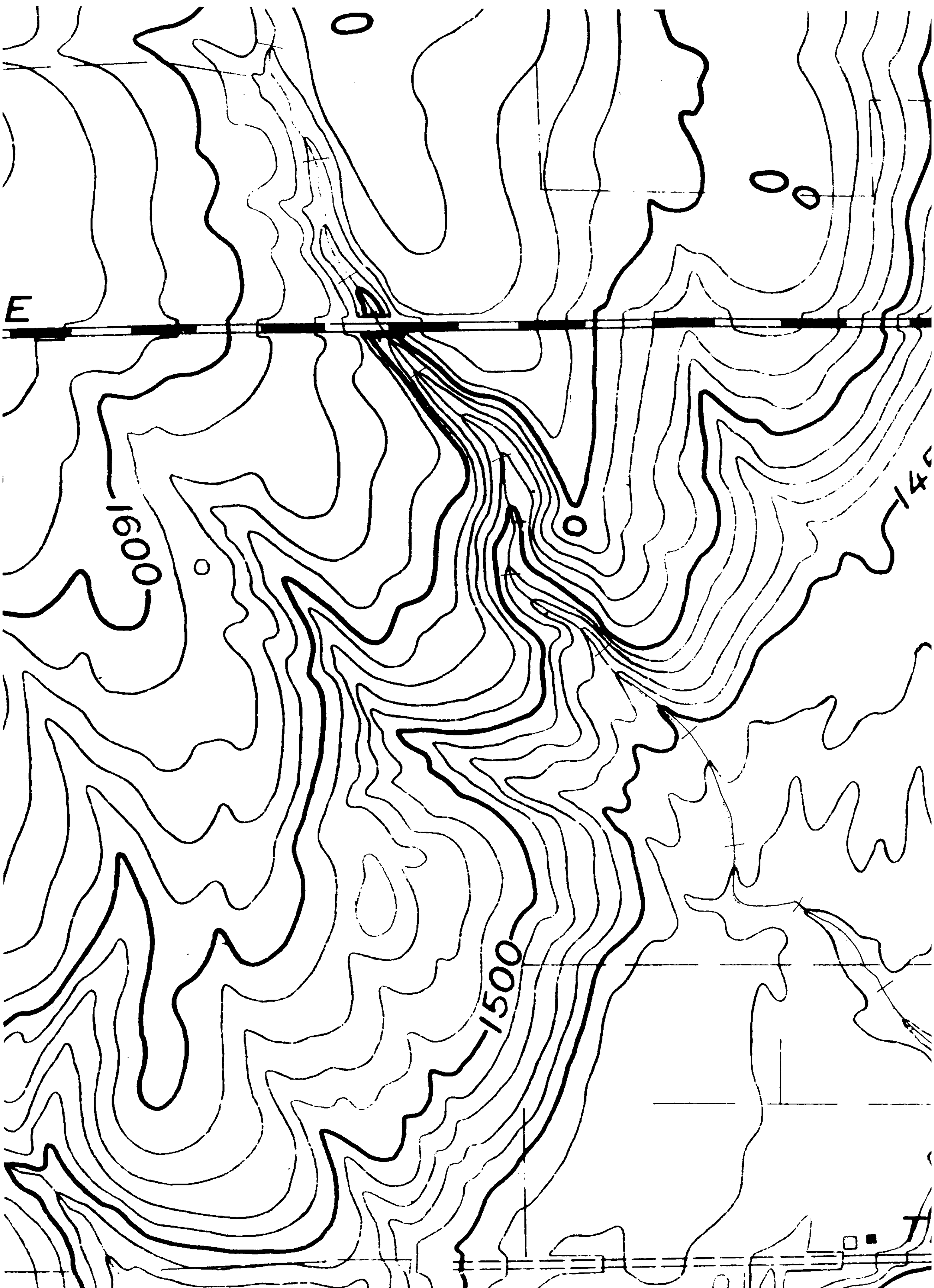
DISTANCE IS MEASURE
FROM THE CONFLUENCE WITH C
Legend:
100-YR. FLOOD
500-YR. FLOOD
Cross Section
Stream bed
Bridge



FLOOD PROFILES
HOSMER BROOK
TOWN OF SARDINIA
ERIE, CO., NEW YORK
PLATE 1 OF 1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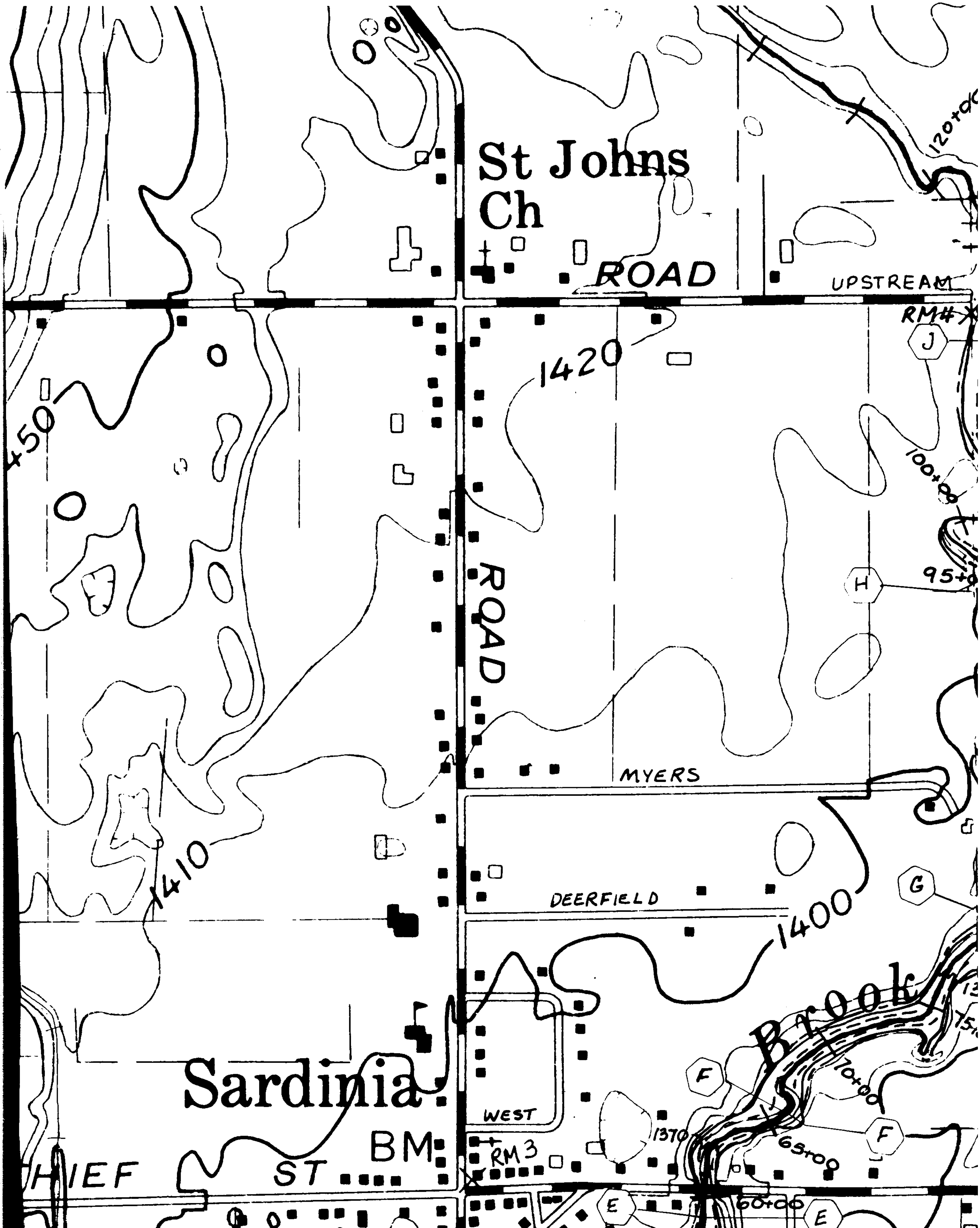
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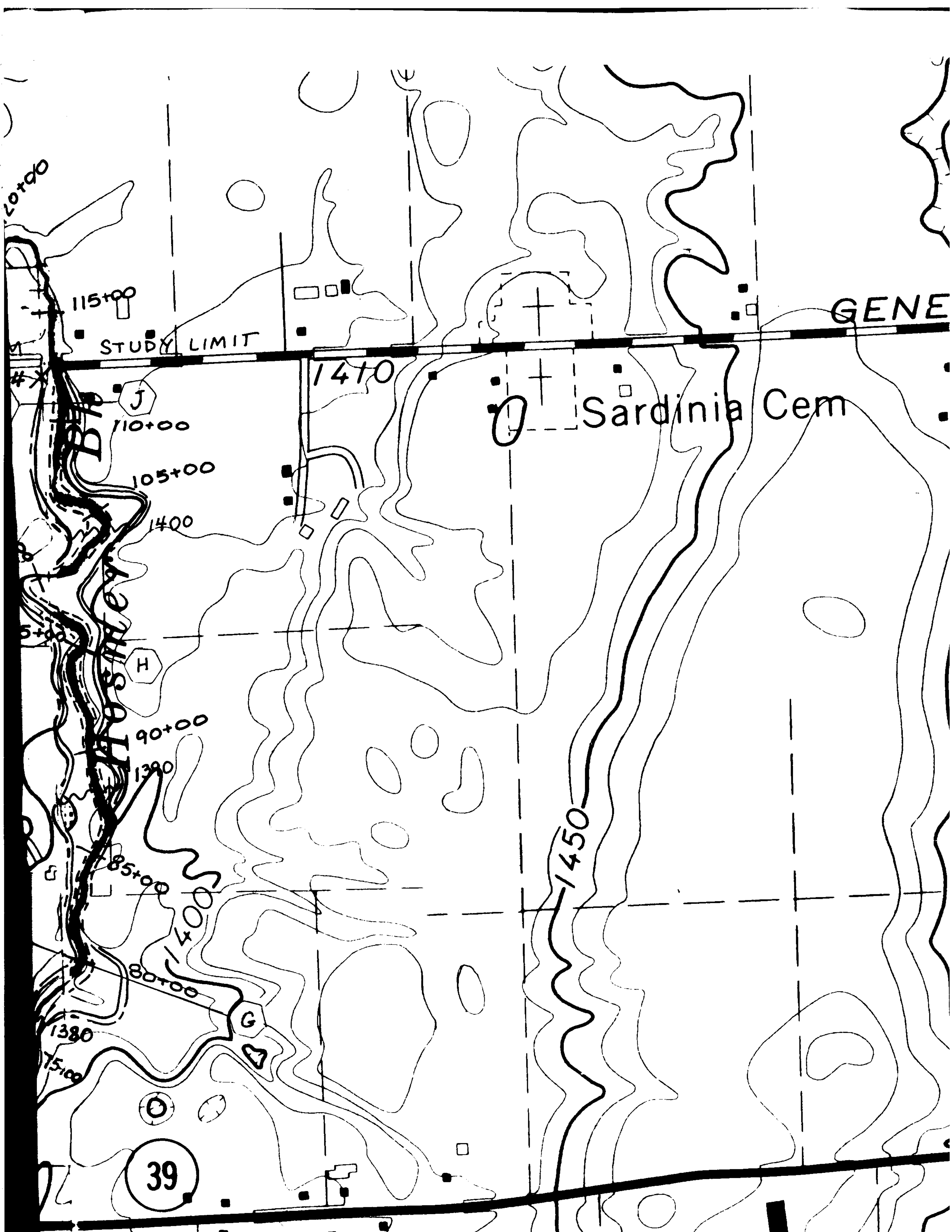

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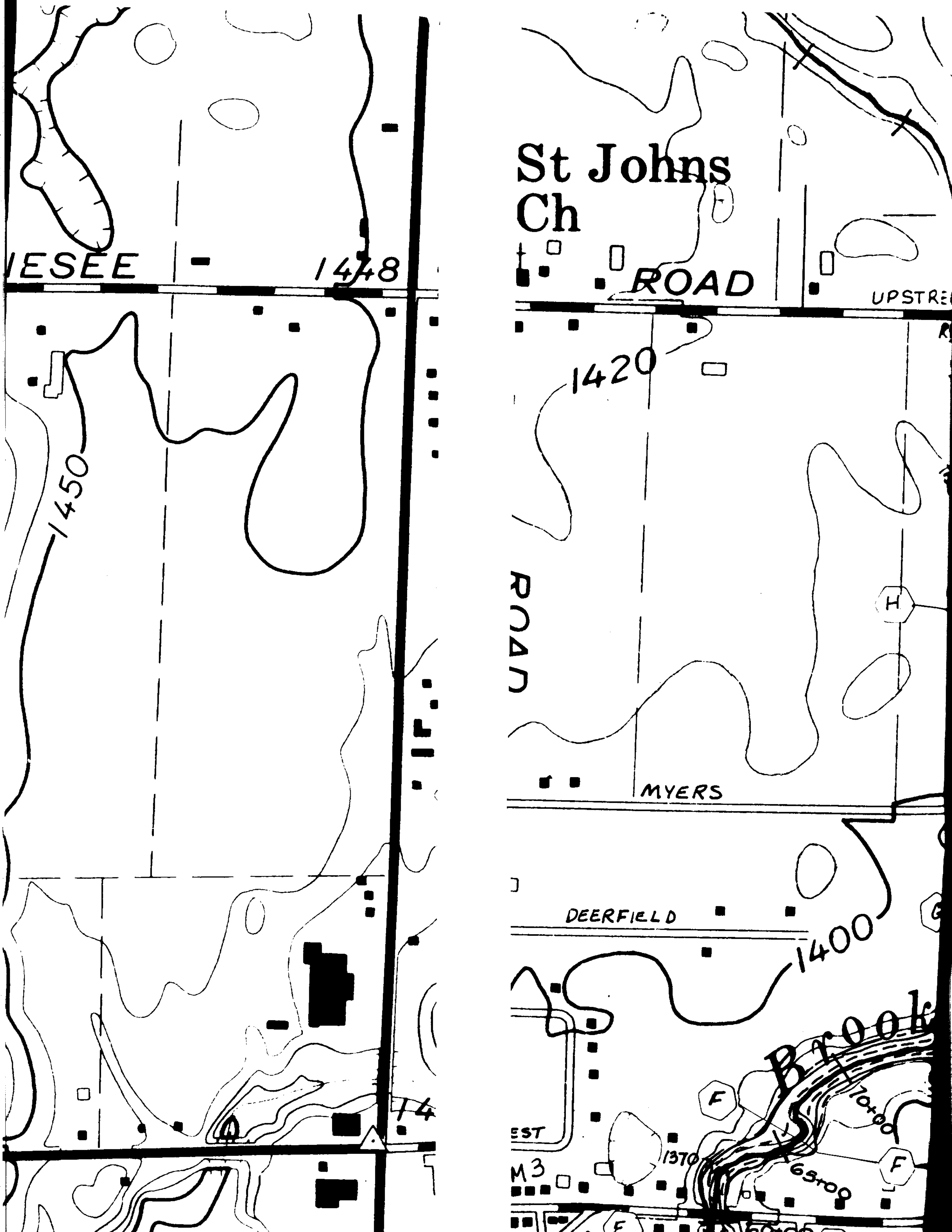

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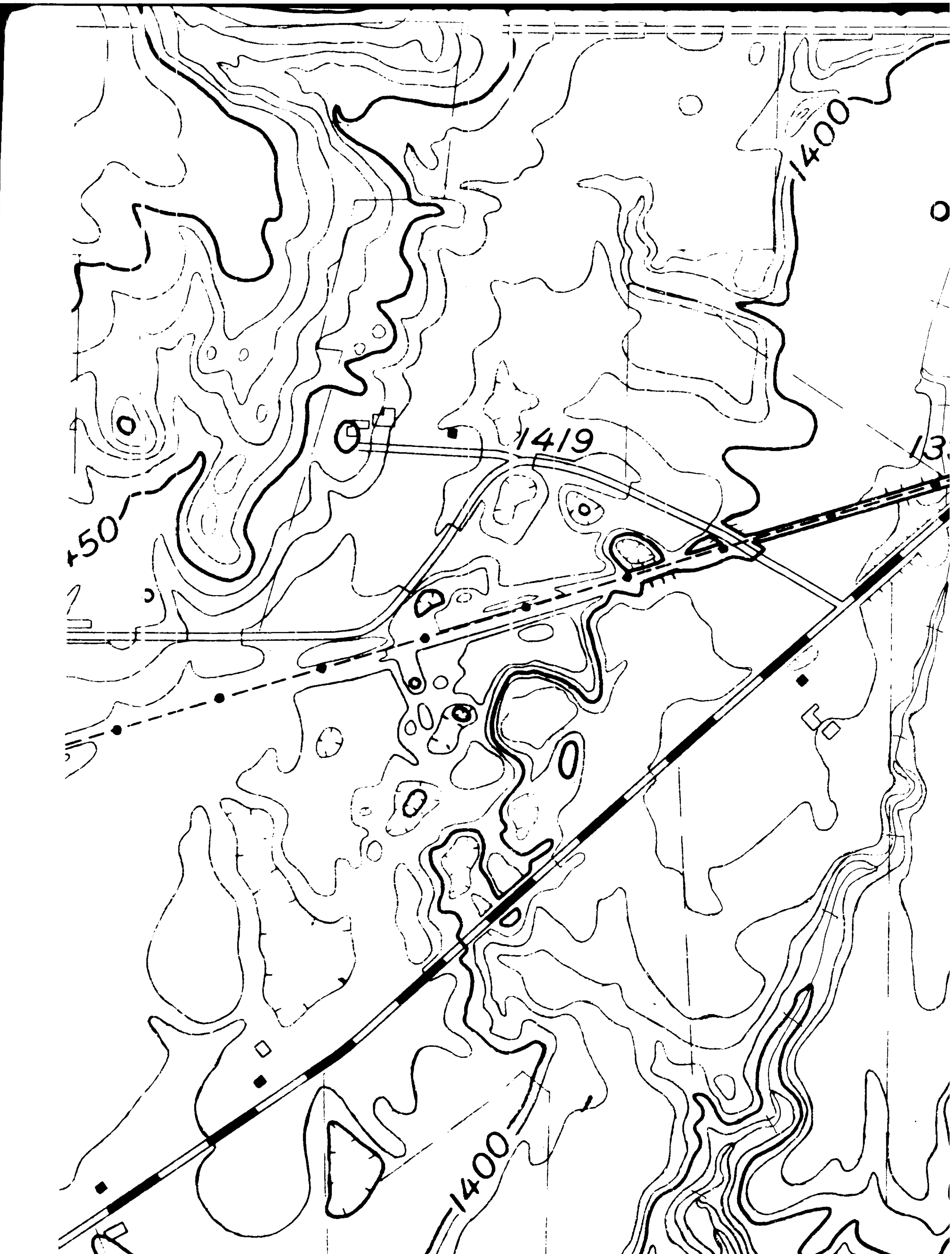
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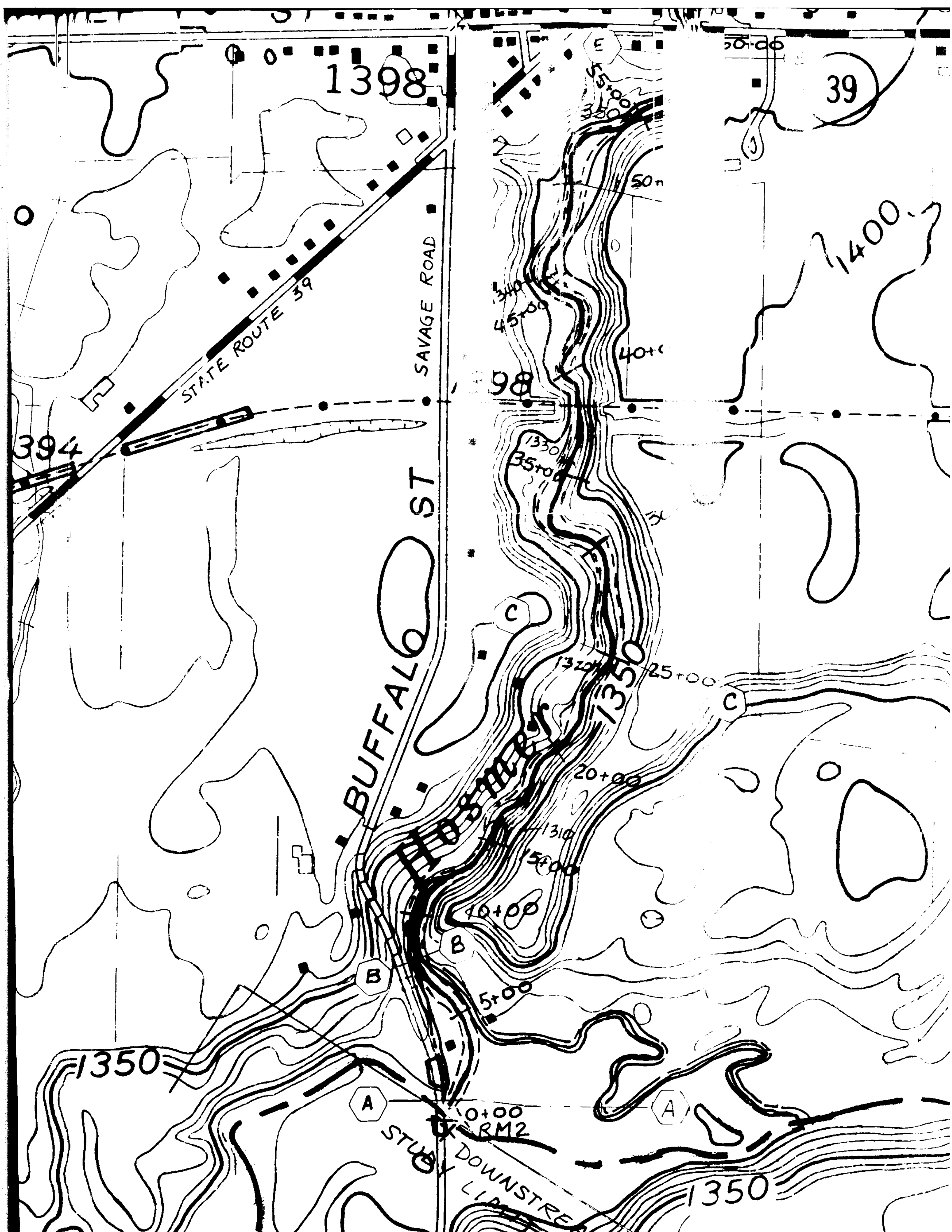

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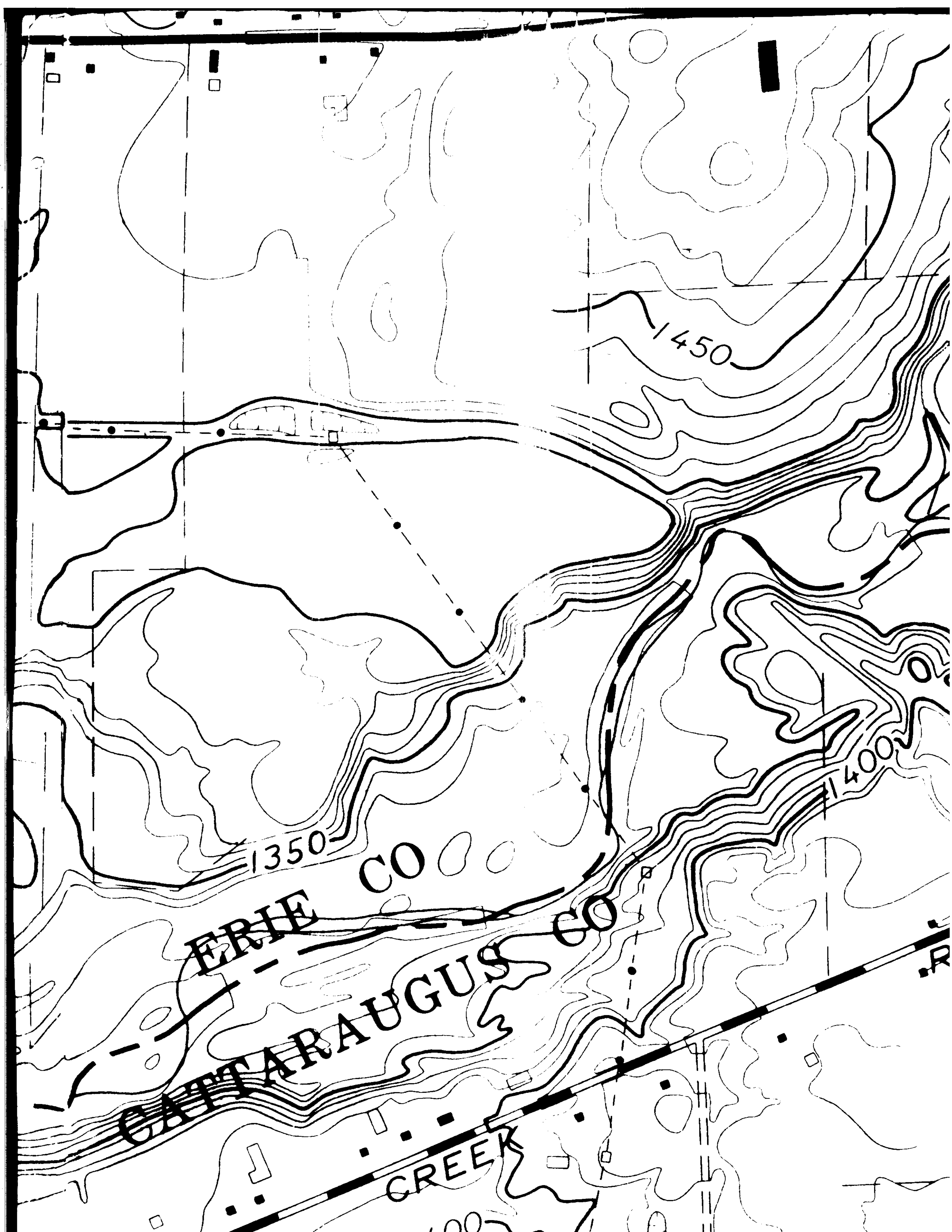
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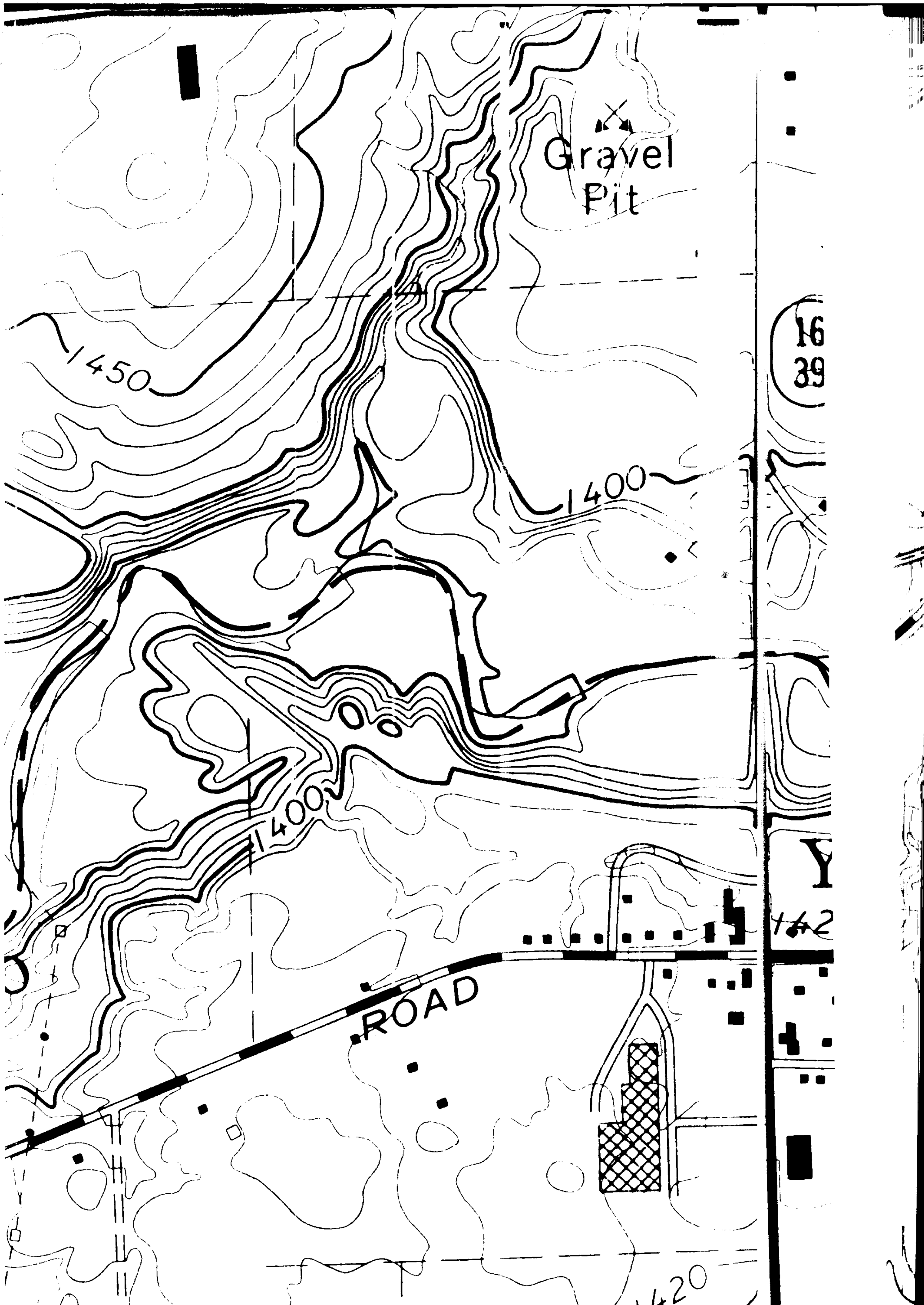
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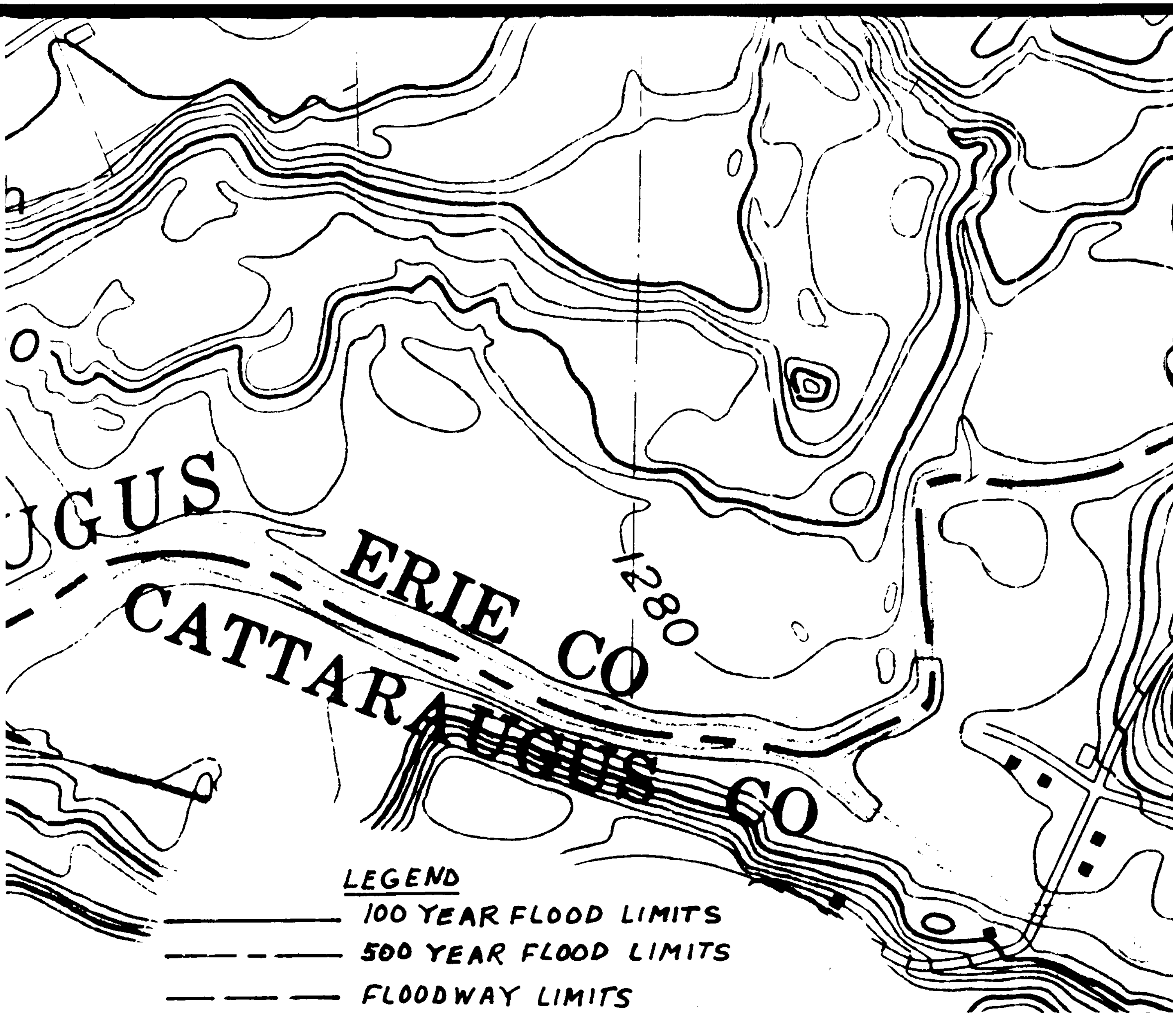
ROAD
1420



LEGEND

100 YEAR FLOOD LIMITS

500 YEAR FLOOD LIMITS

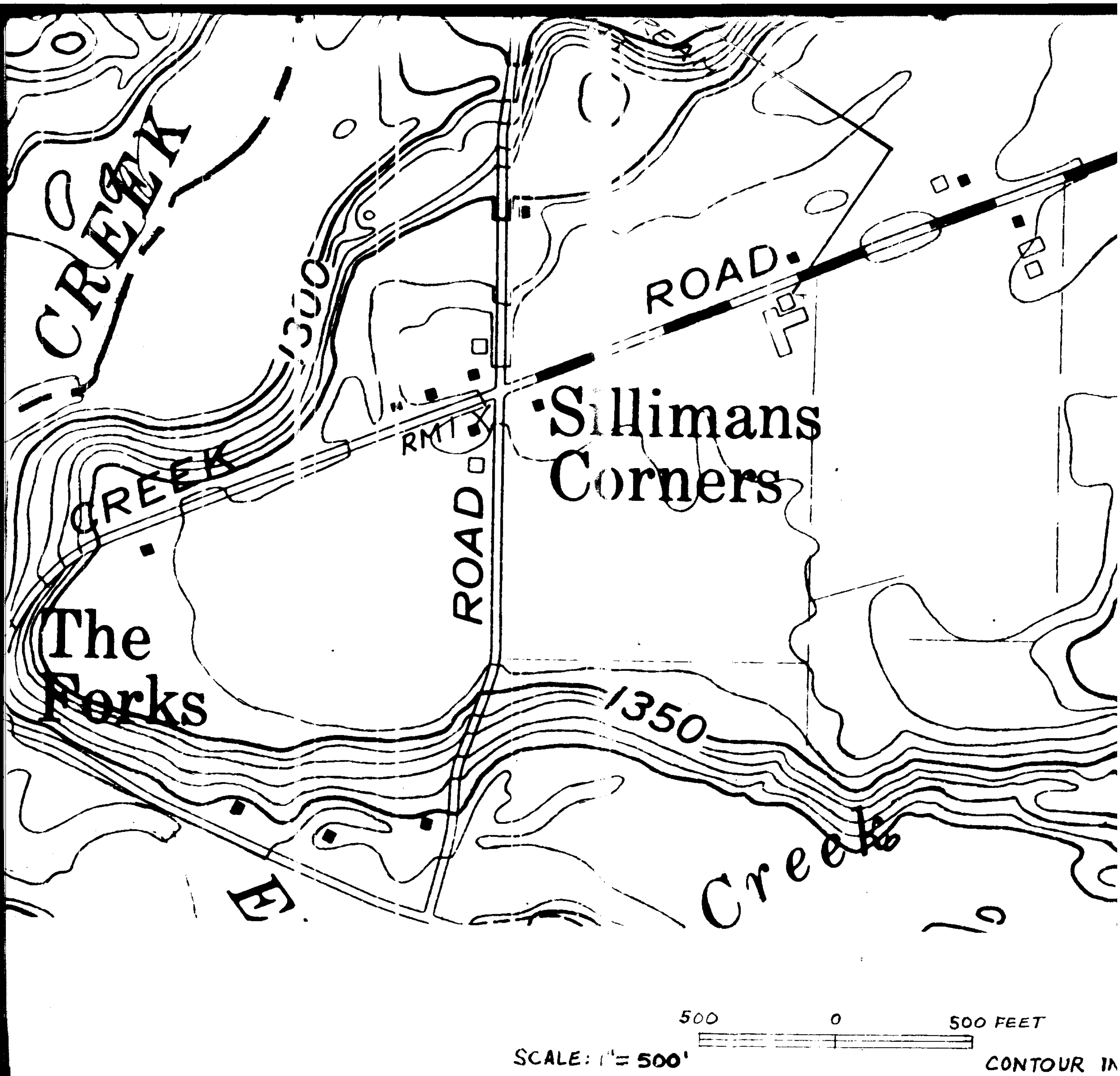
FLOODWAY LIMITS

(A)——(A) CROSS SECTION LOCATION

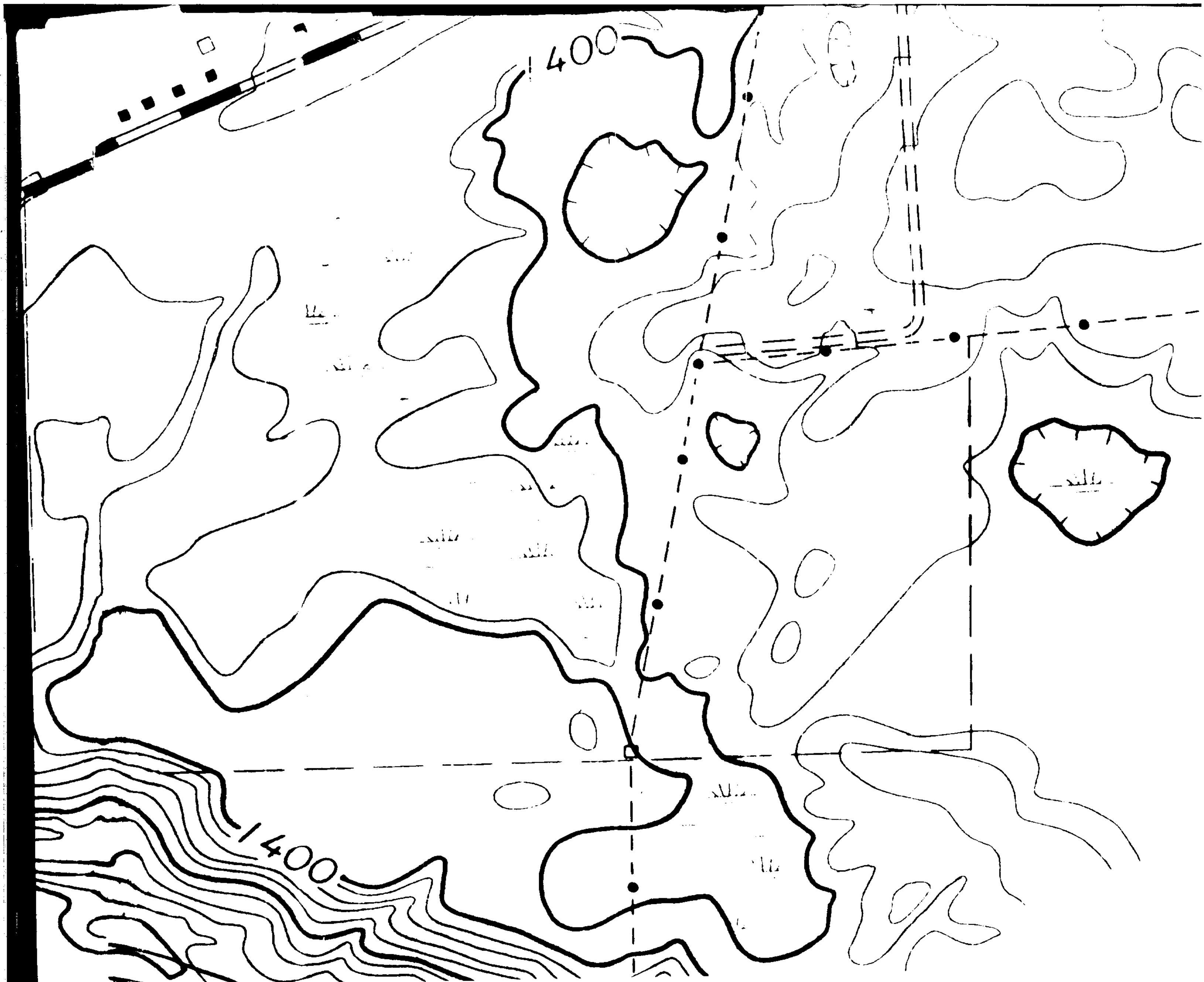
RMI X ELEVATION REFERENCE MARK

HYDRAULIC BASELINE

650 BASE FLOOD ELEVATION



CREEK
ROAD
1300
Sillimans
Corners
RM1 X
CREEK
ROAD
The
Forks
1350
Creek
500 0 500 FEET
SCALE: 1" = 500'
CONTOUR IN



SPECIAL FLOOD HAZARD EVA

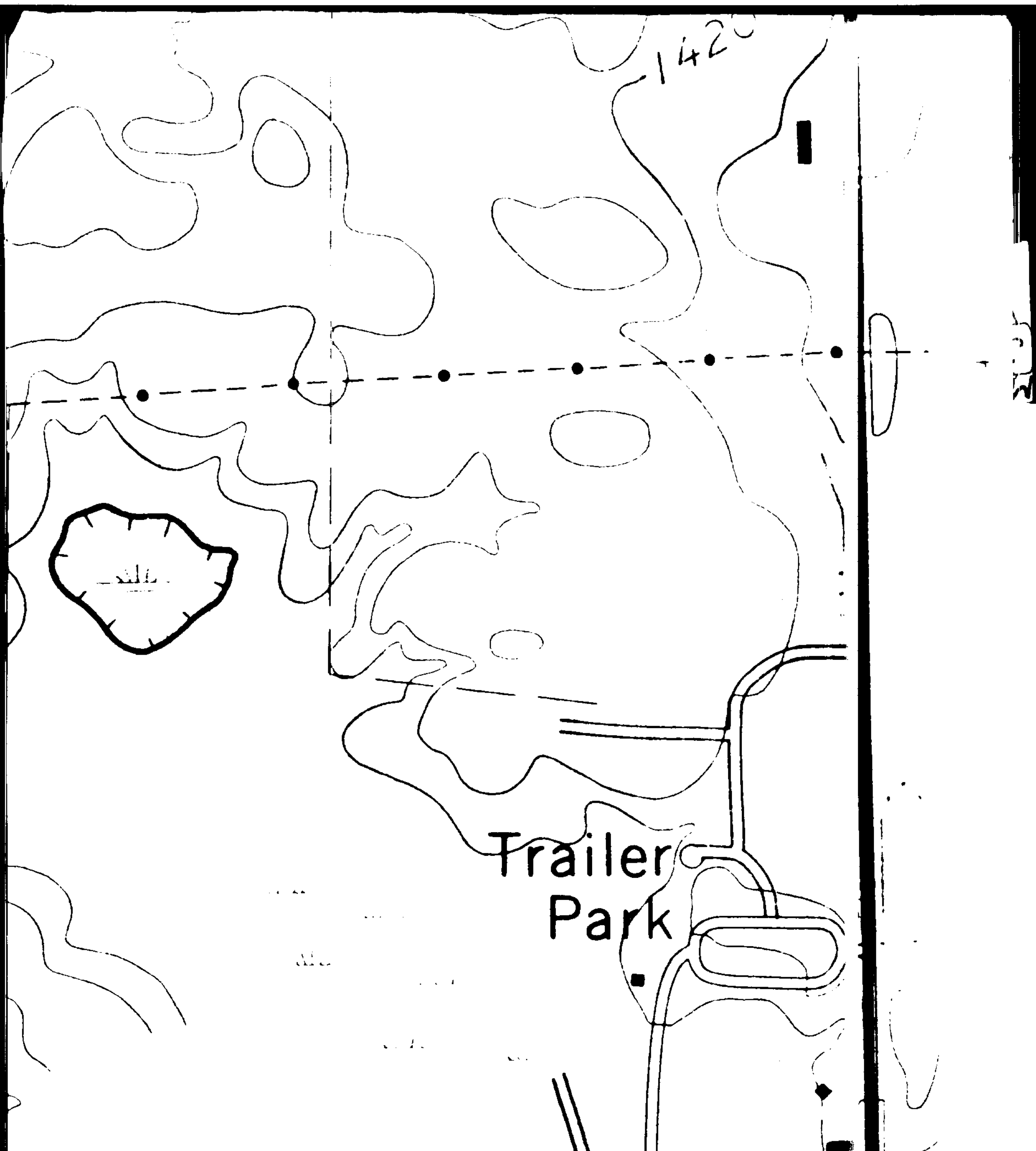
FLOODED AREA MA

HOSMER BROO

TOWN OF SARDINIA

ERIE COUNTY

OUR INTERVAL: 10'



OOD HAZARD EVALUATION
ED AREA MAP
SMER BROOK
OF SARDINIA, NY
RIE COUNTY